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U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 228.

# FOREST PLANTING AND FARM MANAGEMENT.

BY

GEORGE L. CLOTHIER,
ASSISTANT FOREST INSPECTOR, FOREST SERVICE.


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# LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
*Washington, D. C., August 8, 1905.*

SIR: A paper on Forest Planting and Farm Management, prepared under my direction by Mr. George L. Clothier, of the Forest Service, and published in the Yearbook of the Department for 1904, is herewith submitted, with a few slight alterations, for republication as a Farmers' Bulletin.

Respectfully,

GIFFORD PINCHOT,
*Forester.*

Hon. JAMES WILSON,
*Secretary of Agriculture.*

# CONTENTS.

# ILLUSTRATIONS.

# FOREST PLANTING AND FARM MANAGEMENT.

## FORESTRY AND FARM DESIGNING.

Although agriculture stands first among American industries and our production of farm products is greater than that of any other country, the possibilities of the art of agriculture have hardly begun to be understood. That scientific farming will vastly increase the productive power of the land in the United States is beyond doubt. With the advance of knowledge through the discovery of new truths and the advance in practice through the better application of what science has already found out, improved utilization of the country's resources will make room for a future rapid growth in population and wealth, as expansion in territory has made room in the past. Making the same land twice as productive as before is as good as doubling the amount of land, if not better, and we have as yet scarcely scratched the surface of the agricultural resources of the country as a whole. One of the ways in which present methods of farm management may be greatly improved is by better recognition of what may be called farm engineering, or farm designing; and this in turn must give an important place to the consideration of farm forestry.

The farm designer, or farm architect as he might be called, can do much to improve the efficiency of farm operation. Economical management may be attained by a scientific adjustment of the parts of a farm, just as the utility of a great building may be increased by the careful planning of a qualified architect. Several agricultural colleges and experiment stations have recognized this fact, and have given a distinct place to this as a part of the great problem of how to get the most out of the soil. The best opportunities to apply these principles are found in those parts of the West where new farms are being taken up. Generally it is also in these regions that forestry can do most for the farmer, for in the treeless regions, especially, the full development of the country depends in no small degree on the establishment of forest plantations.

From the fact that trees take so much time to grow, the forester who seeks to advise a farmer how he can make trees contribute most

largely to his prosperity is compelled to take a long look ahead and to consider the whole problem of farm arrangement. In well-settled regions the possibilities of farm designing are apt to be severely limited by what has been done in the past. The location of the buildings, the division into fields, and in many cases the situation of the timber, are now fixed facts. Nevertheless, even here a decided improvement may often be made, as will be illustrated later. What needs to be emphasized now is that even in the older parts of the country a farm should be run according to a definite and carefully considered plan, designed to secure economy of operation and the best use of every part; that tree planting for farm purposes ought always to take into account this plan; and that even where standing timber is already present it may be in the interest of the best use of all parts of the farm to cut this down and plant elsewhere.

## THE NEED OF FOREST PLANTING.

Forests are indispensable to the highest material development of any country. We have learned that, besides furnishing the useful timber products resulting from the growth of trees, they conserve moisture, ameliorate climatic extremes, and purify the atmosphere. Where they are not found naturally, or where they have been thoughtlessly removed from wide stretches of country, it becomes desirable in behalf of the public welfare to plant trees in great number. Obviously the benefits of such plantations will be most widely felt if the planting is well distributed over the region. Further, it is a work the benefits of which are shared by all, and which all should join in performing.

The plantations in a definite region should be made after one general plan, in order to allot to each farm its proportionate amount of forest. The method of planting and the position of the planting sites should evidently be made with reference to a system of farm management, since a forest is the most permanent thing that can be planted on a farm. An example of such a plan and such a system is shown in fig. 1.

## MISTAKES OF THE PAST.

It is unfortunate that a large percentage of the plantations made by farmers have been disappointing. Yet some commercial plantations, such as that of Mr. L. W. Yaggy, at Hutchinson, Kans., have been financially successful.

Farm forest planting has been practiced in some of our prairie States for more than half a century, and great good has resulted from many of the plantations, but the measurable increase in the wealth of the country attributable to forest planting has been small, owing to

the choice of poor sites and the use of unsuitable species. The artificial forests of Illinois would have been worth many times what they are at present if longer-lived and more valuable species had been used in the plantations instead of silver maple or other trees of as little worth. Species of the greatest value have often been ignored because of their slow growth, and others, deserving to be classed as "weed trees," have been used in their place. Successful plantations of black walnut, hickory, elm, oak, and other valuable trees are common enough to prove that the slower-growing woods ordinarily pay best. Silver maple, boxelder, and the like are valuable chiefly for firewood, and it is easily possible to overstock the market for cordwood in any locality. Lumber woods, on the other hand, can always be disposed of in any quantity.

In order to illustrate the relative values of the two classes, let a comparison be made between the returns from a 64-year-old stand of black walnut in Morgan County, Ill., and a 35-year-old stand of silver maple in Sangamon County. These were the best groves of each species found in the State during an extended survey made in the summer of 1904. The figures relating to the two tracts may be best contrasted in the following table:

*Value of planted forests of black walnut and silver maple on the prairies of Illinois.*

| Species. | Location. | Age. | Area. | Number of trees on area. | Average diameter breast-high. | | |
|---|---|---|---|---|---|---|---|
| | | | | | Dominant trees. | Intermediate trees. | Suppressed trees. |
| | | *Years.* | *Acres.* | | *Inches.* | *Inches.* | *Inches.* |
| Black walnut | Morgan County, Ill. | 64 | 0.6 | 119 | 19.0 | 13.3 | 9.4 |
| Silver maple | Sangamon County, Ill. | 35 | 5.6 | 1,478 | 10.6 | ..... | ..... |

| Species. | Location. | Number of trees per acre. | Yield per acre. | | | Total value per acre.[b] | Annual value per acre.[c] |
|---|---|---|---|---|---|---|---|
| | | | Lumber.[a] | Fence posts. | Firewood. | | |
| | | | *Board ft.* | | *Cords.* | | |
| Black walnut | Morgan County, Ill. | 198 | 42,000 | 1,800 | 15 | $1,050 | $5.58 |
| Silver maple | Sangamon County, Ill. | 264 | ..... | ..... | 65 | 130 | 2.15 |

[a] From trees 11 inches and over in diameter breasthigh.

[b] Lumber at $20 per 1,000 board feet, fence posts at 10 cents each, and firewood at $2 per cord.

[c] Interest compounded annually at 3 per cent.

It would be quite as easy to show that the returns from hickory, elm, or some other wood which can be used when no older than the maple would amount to more than those from the latter, but the comparison of walnut with maple serves also to emphasize the greater

5116—No. 228—05——2

value of a wood which must be kept until the trees attain a good size. The figures in the last column represent the annual returns from the two plantations irrespective of their age, and are therefore directly comparable.

It is a well-known fact that the great majority of the forest plantations made in accordance with the timber-culture act were failures. Here, again, the unfavorable results were due to poor sites and ill-adapted species, combined with a lack of care on the part of planters and the dishonesty of entrymen, who regarded this law merely as a means of obtaining title to public land without paying for it.

Plantations made by specialists and designed for a special purpose do not usually require very elaborate planting plans. It is the small woodlot plantation that is to serve many purposes in the economy of the farm which calls for the most careful planning.

## PREPARATION OF A PLANTING PLAN.

As a machine of production, a farm should have a plan which provides for the best use of its every part. The woodlot or forest plantation should be in a position to contribute to the successful operation of this plan, for the trees may affect the atmospheric drainage, the wind currents, and the humidity of the air about the home. At the same time a planting plan must provide for sites which will produce the best possible growth. The arrangement of the fields and the location of the fences, private lanes, drainage systems, buildings, and farmstead should all be considered before any forest planting is undertaken.

Very rarely indeed have farmers deliberately planned the location and make-up of their forest plantations with reference to the needs, convenience and economy of their farms, and the relative value and adaptability of the trees to be planted. Woodlots have sometimes been so poorly located as to do actual damage to farms. Cases have been observed in the northern half of the Middle West where windbreaks planted too close to the buildings caused the drifting snow of severe winters to bury the houses 15 or 20 feet deep. In the winter of 1899 a farmhouse in the Red River Valley, North Dakota, was buried in a snowdrift for three months because a cottonwood grove had been planted too near it. In other cases trees have been planted near tile drains, which the roots clog.

It is probable that not one-tenth of American farms are being operated under any permanent system of management. Before forest planting is undertaken some such system must be adopted, however, in order to make the future existence of the forest plantations possible, for more than half the planting plans made since July 1, 1899,

by the Forest Service, fundamentally affect the future management of the farms. As very few farmers are accustomed to formulating farm plans, the agent of the Forest Service, besides being called upon to give advice in matters pertaining to technical forestry, is usually drafted into this service as well. After consultation with the landholder and consideration of all the matters affected by the policy of management, he is able to bring out an orderly arrangement which will permit on the same farm the practice of both scientific agriculture and scientific forestry.

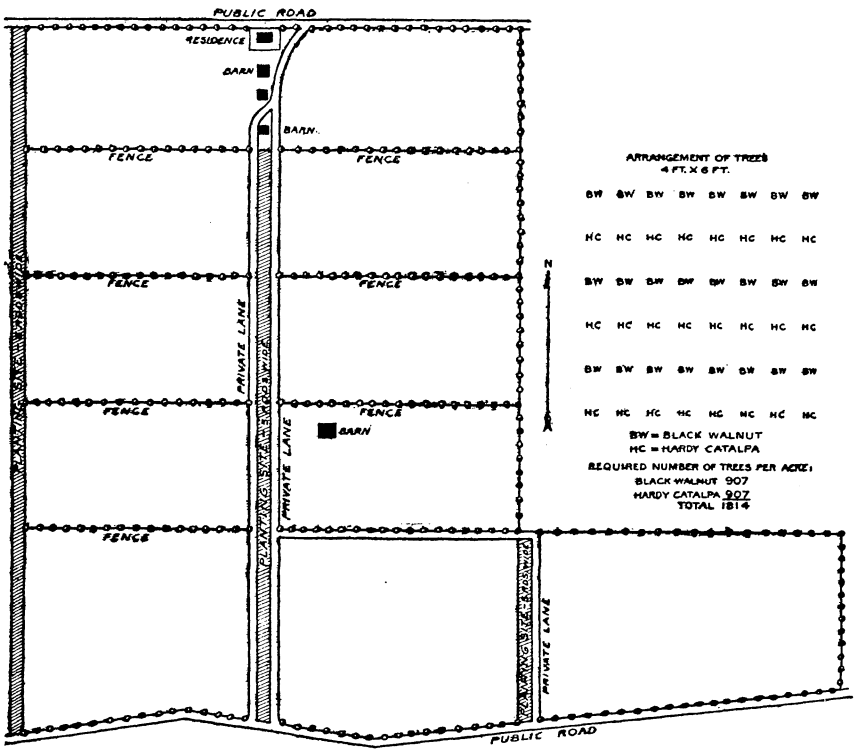


FIG. 1.—Arrangement of forest plantations on a farm in central Ohio to facilitate scientific farm management.

## A CONCRETE EXAMPLE.

The planting plan shown in fig. 1 was made for a farm in central Ohio, and illustrates graphically the bearing that forest planting may have on the management of a farm. This farm in Ohio contains 375 acres, and that part of it which is devoted to agriculture is capable of earning interest on a capitalization of $100 per acre; not a foot of it is unsuited to tillage. That part which was originally heavily timbered has all been cleared, except a blue-grass pasture of 30 or 40

acres which is occupied by the remains of the original forest, consisting of a scattered stand of declining sugar maple and beech trees. This timberland embraces the most fertile part of the farm, and interferes most seriously with the convenient and economical division of the farm into fields. If the Forest Service had advised the owner to attempt to rejuvenate the dying trees and to underplant them with expensive nursery stock, the instructions would have been implicitly followed, but such advice would have wrought a positive injury to the landholder. Instead, the planting plan advises that the forest area of the farm be reduced by clearing the only natural timber left standing, and that, instead of retaining the scattered growth now cumbering the pasture, trees sufficient to occupy about half the present forest acreage be planted in such positions as to protect the farm from the severe westerly winds prevailing in the region.

The owner was therefore advised as follows:

(1) The major part of this farm is too valuable for agricultural purposes to be devoted to forestry. The native timber now scattered over the pasture is rapidly declining, and is reduced by every hard storm. No natural reproduction is taking place, and while the land is grazed none can be secured. The location of the scattered trees in the middle of the farm would require expensive fencing in order to protect them from live stock. Thus, it is believed that the rejuvenation of the old forest on this farm is impracticable. Instead, this land, as soon as the old trees have all disappeared or been removed, should be laid out into permanent fields. As every well-regulated farm, however, should possess some timber land to supply it with fence posts and to furnish shade and shelter for live stock, new plantations are recommended. The trees will take up as little room as possible, while the arrangement of the fields in rectangular blocks will greatly facilitate the use of modern machinery.

(2) The chief plantations should occupy strips 5 rods wide, running from north to south. One of these strips should be planted on the western border of the farm and another crossing its center due south of the residence. A third should cut off the block extending east from the southeast corner of the main rectangular tract. In addition to these strips, it is advised that single rows of trees be planted on the division lines between the fields, so that they may be used as live posts upon which to fasten wire to form fences. (See fig. 1.)

(3) Black walnut and hardy catalpa should be used in equal proportions for the belts, and should be planted every 4 feet in alternating rows, which should be 6 feet apart. The walnut seed should be planted two years prior to the introduction of the catalpa seedlings, in order to allow the slow-growing walnut to get a start before being

crowded by the catalpa. The nuts of the walnut should be collected as soon as ripe in the fall, and should either be stratified [a] in moist sand or planted immediately in their permanent site. These nuts should never be allowed to dry out after ripening. They are most easily planted while plowing, by dropping them in a furrow and covering them with the next furrow slice. If walnuts are thus planted, the squirrels are not likely to find them. The ground between the rows during the following two years should be planted with corn, and should receive good tillage. This can best be done by use of the lister. After the catalpa seedlings are introduced no more corn should be planted, but the ground should be cultivated as long as a single-horse cultivator can be run between the rows. Catalpa seedlings 12 to 16 inches tall and one year old should be used. They can be obtained from dealers for $1.50 to $5 per thousand. The labor of planting these seedlings may be performed chiefly by horsepower. Both walnut and catalpa should be planted in accordance with the diagram shown at the right in fig. 1.

By consulting the illustration the reader will see that the planting plan subdivides this farm into eleven fields—eight rectangular ones of equal area and similar dimensions, and three of nearly equal area but of unlike dimensions. This division will permit the application of scientific crop rotations, the eight rectangular fields being suited to two systems of four-year rotations and the three irregular fields to one three-year rotation. The convenient shape, ease of cultivation, and wonderful fertility of this farm present an excellent opportunity for the arrangement of such rotations of suitable crops.

Trees planted on the lines which separate the fields will serve as windbreaks as well as living fence posts. A method adopted by some is to plant Osage orange hedges between the fields, and every 20 feet to allow one of the trees to grow to its natural height. The remaining trees should be pruned to a height of 5 feet and kept within proper limits for a hedge. Then, if this growth proves inefficient as a fence, it can be reenforced by fencing wire stapled to the large trees. If the Osage orange is undesirable or a hedge is not wanted, chestnut should prove a desirable tree for the fence lines. The young trees should be planted about 20 feet apart, and when they begin to crowd each other every alternate tree should be cut out. Round-headed and with sturdy trunks, these trees will form very effective windbreaks for the intervening fields. Their nuts will bring a satisfactory return for the land they occupy, and the trees which are cut out will furnish excellent fence posts. The substitution of straight woven-wire fences for the old zigzag ones of rails transforms the fence lines from breed-

[a] Stratification is a method of storing forest seeds to prevent them from drying out. The seeds are stored in alternating layers between layers of moist sand.

ing places for noxious weeds into productive land upon which the living fence posts grow into a merchantable product.

Such a plan as this fixes the boundaries of the fields, locates the private lanes, and, in fact, forms the skeleton of any future system of farm management that may be applied to this farm.

## A MODEL PRAIRIE FARM PLAN.

In order to illustrate a model prairie farm plan made in accordance with sound principles of forestry, fig. 2 has been prepared. This

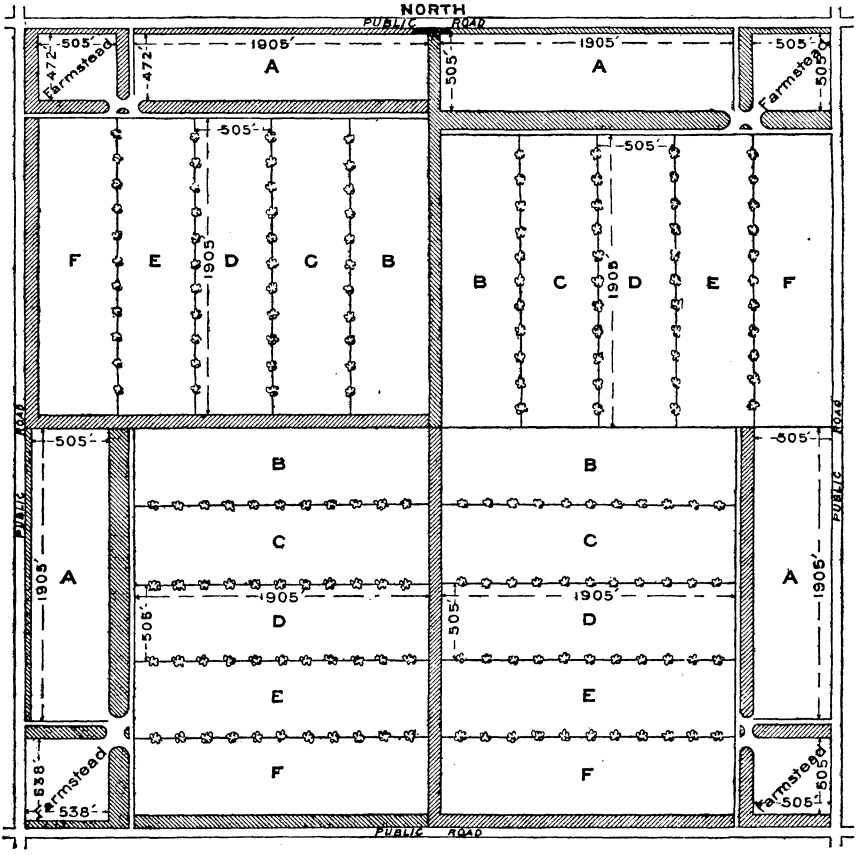


FIG. 2.—Ideal plan of the four quarters of a section with location of forest and windbreak plantations—suited to the prairies of Kansas and Oklahoma.

farm plan is applicable to a large region in the prairies of the Middle West, where windbreaks are necessary to the full development of the country. It assumes that the land is of uniform condition of soil, and has been surveyed by the rectangular system adopted by the Government. The public roads are supposed to be located on the section lines. The application of this model to a country with its

surface broken by creeks or lakes would, of course, necessitate a modification to fit local conditions. The plan is intended merely to illustrate principles.

Four farms of 160 acres each are shown, illustrating an arrangement suitable to each of the four quarters of a section. The farmstead, or that portion of a farm which is occupied by the residence, barn, orchards, gardens, lawn, and feedlots, is here shown as placed at the section corner of each farm. While in a large proportion of cases the location of the farmstead will be determined by the particular conditions, as water supply, topography, etc., an arrangement, where practicable, by which the houses stand on the section corners will be worth considering.

The fields on each quarter section have been laid out to permit the planting of windbreaks to protect the crops from the hot southwesterly winds of summer and the cold northwesterly winds of winter. The farmsteads are also provided with protection from winds. East winds have not been considered, because of their infrequent occurrence, but a general adoption of this plan on all the farms of a region would afford protection from all points of the compass.

The fields, with one exception, are all of the same shape and size, there being on each quarter section six fields, each 22.1 acres in area. This method of dividing the farm into fields will afford an opportunity for the application of a scientific system of crop rotation, and the fields, being six in number, will permit the application of a compound rotation embracing the use of a perennial crop like alfalfa in combination with five annual crops, where this is desired. If the use of a perennial is not desirable, the six fields will permit the running of two parallel three-crop rotations.

## TREES AND METHODS RECOMMENDED.

The plan provides that the forest trees shall be planted in belts varying from 2 to 8 rods in width, except along fence lines, where they are in single rows. The best results, purely from the standpoint of forestry, will be obtained in the widest belts, since trees are social in their habits. Still better tree growth would be secured by planting in compact blocks. But as agriculture is the fundamental industry in the region to which this plan applies, the tree planting is designed only to supplement the production of field crops. Eleven or 12 per cent of each quarter section is to be devoted to forest. This is exclusive of the space occupied by the single lines of trees in the fence rows.

The species that may be recommended for this purpose vary for each particular locality with conditions of climate, rainfall, and soil. Considering the Middle Western States together, however, the fol-

lowing trees, when placed on hospitable soil fulfilling the requirements of each individual species, may, in the northern half of the region, be successfully grown as windbreaks:

| | | |
|---|---|---|
| Arborvitæ. | White elm. | Laurel-leafed willow. |
| Green ash. | European larch. | Russian golden willow. |
| Boxelder. | Russian wild olive. | White willow. |
| Cottonwood. | Western yellow pine. | |
| Cork elm. | Black Hills spruce. | |

In the southern half of the Middle West, also the green ash, cottonwood, white elm, Russian wild olive, and western yellow pine may be successfully grown, and in addition the following species:

| | | |
|---|---|---|
| Chinese arborvitæ. | Honey locust. | Osage orange. |
| Wild China. | Mesquite. | Persimmon. |
| Black locust. | Russian mulberry. | Shittimwood. |

These lists do not include all of the best timber trees that might be grown in the Middle West, for many valuable timber trees will not endure such severe exposure as a windbreak is subject to.

In the establishment of a windbreak wisdom is required in the placing of the different species. A windbreak composed of more than one species is usually the most effective. An excellent method of arrangement is to place the shortest trees in the outside row (toward the prevailing wind), to plant a somewhat taller species next to them, and to place the tallest trees in a third row on the side adjacent to the buildings or the area which is to be protected. This causes the wind to strike the trees as it would strike the face of a steep hill, deflecting its course upward. If the tallest trees of the third row consist of a flexible species, such as cottonwood, European larch, white willow, or honey locust, they will bend before the wind, and act as a cushion to deflect it upward and over the object to be protected. A satisfactory windbreak 5 rods in width, for the protection of the north and west sides of a farmstead (see fig. 2) and adapted to Minnesota and the Dakotas, is as follows: Plant 13 rows of trees, parallel to one another and 6 feet 10 inches apart. The first two rows on the north and west edges of the belts should consist of Russian wild olive, the third and fourth rows of arborvitæ, the fifth and sixth rows of boxelder, the seventh and eighth rows of white elm, the ninth and tenth rows of white willow, and the remaining three rows of common cottonwood. Such a plantation, when mature, will appear like a wall with a sloping top, the highest side being where the cottonwoods are planted.

Carrying out this same principle for Oklahoma and Texas, with a change in the position of the plantations to afford protection from southwest winds (see fig. 2), the following method is advised: The

first two rows on the south and west edges of the belts should consist of Russian mulberry or Osage orange, the third and fourth rows of Chinese arborvitæ, the fifth and sixth rows of black locust, the seventh and eighth rows of green ash, the ninth and tenth rows of white elm, and the remaining three rows of honey locust or common cottonwood.

In southern California, where the damaging winds come from opposite points of the compass (from both the southwest and northeast), a good plan for a windbreak is one in which the tallest, most flexible trees will be in the center rows, so that the species on either side will slope downward toward the outside edges of the belt. For such a windbreak 2½ rods wide and consisting of 7 rows of trees, the following arrangement may be suggested: The three rows in the middle of the belt should be of blue gum (*Eucalyptus globulus*), the next row toward the outside on each side should be of Monterey pine (*Pinus radiata*), and the two rows occupying the two edges of the belt should be of Monterey cypress (*Cupressus macrocarpa*). This same arrangement may be used on a belt 5 rods wide by doubling the number of rows of pine and cypress and increasing the gum to five rows. In order to construct a windbreak in California that will be perfectly effective, the belts should be placed on all four sides of the area which is to be protected. This is illustrated by the farmstead on the northwest quarter of the section shown in fig. 2.

The belts advised in the model plan are of sufficient width to produce all the timber that will be needed on a farm of 160 acres, while the fields are sufficiently narrow to be protected from winds by the single lines of trees occupying the fence rows. Experiments have demonstrated that a windbreak, on level land, will be effective for a distance of at least ten times its height. For perfect protection on the model farms herein described, the trees in the windbreak must reach a height of at least 50 feet.

An objection to growing trees along fence lines has been made by farmers on the ground that such trees steal the soil nourishment from the crops which are on the edges of the fields. It is true that healthy, vigorous trees make great demands on the soil moisture in their immediate vicinity, but wherever their influence is felt as windbreaks they conserve enough moisture, by preventing rapid evaporation, to more than pay for all that they use. By planting a deep-rooted crop like alfalfa under the shade of the fence-line trees, good returns from the land may be secured in spite of the fact that the trees absorb a part of its moisture. It is a great mistake to begrudge a useful tree the space it occupies, and particularly so in the naturally treeless prairies of the Middle West.

## SPECIAL FEATURES OF FOREST PLANTING ABOUT THE FARMSTEAD.

On rare occasions it is found to be impracticable to concentrate the different elements of the farmstead in one place. (See fig. 3.) In the great majority of cases, however, it is both practicable and economical to have a farmstead, and the choice of its site is of the first importance to the landowner.

If the farmsteads of several adjoining sections were laid out in accordance with the plan herein suggested, four farmhouses would be grouped at each crossroads corner, bringing neighbors together in a little settlement. The position at the crossroads is also likely to facilitate the reaching of church, school, and town. An argument against such an arrangement is the possibility of its leading to neighborhood quarrels.

In many cases, however, uniformity of soil does not exist. The farmstead must then be located with reference to the adaptability of the soil to the forest growth, since a farmstead without trees for shade and shelter is not worthy of the name. The forest planter, therefore, is often the one to determine the location of a permanent site for the farmhouse, and he may also lay out at least the plan of the farmstead itself.

Fig. 3, representing the farmstead located on the southeast quarter of the section sketched in fig. 2, has been prepared to show how forest planting may be made to help every one of the different parts that go to make up the farmstead. Windbreak belts, 5 rods wide, are located on the north, west, and south sides of the farmstead. Open spaces varying from 72 to 96 feet in width have been provided to the north and west of the buildings and orchards, to act as snow traps to catch the drifts during winter storms. Every farmer is familiar with the fact that a hedge or belt of trees on the north side of an east-and-west road will cause the road to be filled with snow during winter, when the wind comes from the north. So the open space on the farmstead will in the same way trap the snow, and will consequently prevent any drifts from forming near the barn or residence or in the orchards. These open spaces may be utilized for garden vegetables, sugar beets, and other annual feed crops, the accumulation of winter snows serving as an annual irrigation to store up large quantities of soil moisture for the garden, and making the land particularly well adapted to this purpose. The trees on the edges of these spaces will, for the same reason, grow very vigorously.

In this plan the convenience, health, and comfort of the tenants of the farmhouse have all been considered in the location of both barn and residence. The grouping of the trees in the background of the

lawn has been made with reference to adornment, but without an attempt to enter into the details of landscape gardening. The plan leaves the lawn in such a shape, however, that the landscape gardener may have full scope for the display of his talents. A plan including, as this one does, complete protection from the hot winds of summer and the cold storms of winter will add greatly to the intrinsic

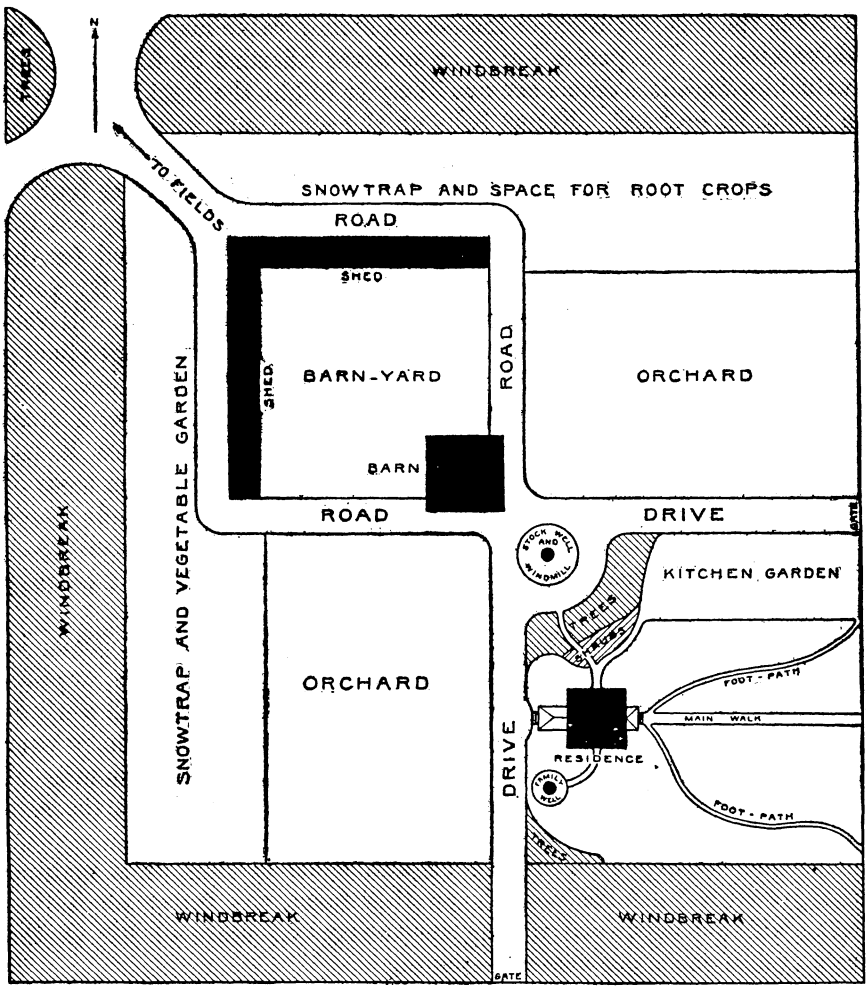


FIG. 3.—Plan of a farmstead, situated at the southeast corner of a prairie farm, arranged to afford windbreak protection.

worth of any farm located in the prairie States. If the farmer is engaged in the production of beef and pork, the protection of the barnyard and feedlots will economize the feed consumed by the fattening animals, for it takes more grain to produce a pound of flesh

upon animals exposed to the cold north winds of winter than upon stock that is protected from blizzards. Thus a windbreak takes the place of grain in maintaining the heat of the animal during cold weather. On the other hand, it will add to the farmer's bank account during the summer, for it will afford shade and protection to fattening animals, which lose flesh in very hot weather.

Windbreak belts in connection with a farmstead form an asset that is none the less real because the actual money value may not easily be determined. The protection to an orchard afforded by forest trees is valuable, since late frosts are not likely to blight the fruit blossoms of a protected orchard. Forest belts on the south and west sides of the farmstead give ample protection against the parching blasts from the southwest—the hot winds of summer, which are destructive to fruit in many parts of the country. It is to be understood, however, that the forest plantations herein recommended are also to be utilized for the production of the needed timber supplies on the farm. By judiciously thinning the plantations, 20 acres of planted forest will furnish all the fuel needed on a farm of 160 acres, besides producing lumber for the renewal of the farm buildings. Many Kansas and Nebraska farmers have in twenty years grown cottonwood trees large enough for sawlogs. Mr. W. D. Rippey, of Severance, Kans., cut 200,000 feet of cottonwood lumber a few years ago from trees of his own planting. Mr. Rippey's plantations were on uplands where the soil is not particularly well adapted to the growth of cottonwood, and, when lumbered, were but little more than a quarter of a century old.

On the farm of Mr. T. F. Eastgate, near Larimore, N. Dak., in the Red River Valley, a belt of planted cottonwood trees, supplemented by a dense undergrowth of wild plum bushes, acts as a windbreak and snow catcher, causing a snowdrift to form in winter over the open field, which is devoted to alfalfa. In the summer of 1904 Mr. Eastgate harvested alfalfa hay from this field at the rate of more than 5 tons per acre.

Besides serving as a windbreak and snow catcher, thus making the growth of alfalfa possible on this farm, the forest plantation has produced cordwood during its twenty-one years of life at the rate of 4.74 cords per acre per annum.

The successful growth of alfalfa on 10 per cent of the area of this region would double the earning power of every acre of land in the Red River Valley; and, since the thermometer here sometimes falls as low as 50° below zero, it is possible to grow this extremely valuable forage only by utilizing some contrivance like Mr. Eastgate's windbreak, to catch the snowdrifts and form during the winter a protecting blanket over the plants.

## CONCLUSION.

Forestry is but a branch of the great industry of agriculture, but it can give important aid to the farmer in getting sustenance for the human race from the soil. It has been shown that where forest planting is desirable, the planting plan is of fundamental importance to the management of the farm which is concerned. The location and cultivation of these forests may either make them peculiarly advantageous or cause them to become a detriment to the economical management of the farm.

The planting plans which have been set forth in the preceding pages are not regarded as perfect, but are given as suggestions of what may be done to make farm forest planting serviceable. They are based on considerable practical experience, and it is believed that they demonstrate beyond a doubt how far superior is a well-considered, systematic method of handling the problems of farm forestry to the haphazard, careless methods so often practiced in the past.

Farmers are now receiving instructions from the Department of Agriculture both for the establishment of forest plantations and for the inauguration of cropping systems, but it seldom happens that the same farmer receives instruction in both matters at the same time. The intimate relations existing between farm management and forest planting are so patent and their importance is so great that the two should go hand in hand. It is to be hoped that as the practice of scientific agriculture spreads, model farms may be laid out in all parts of the United States, on which practicable plans for forest planting may be demonstrated and the best methods of planning the various parts of a farm so as to make provision for an economical and practicable system of crop rotation may be illustrated. Farmers, in order to get the services of Government experts in planning both forest plantations and systems of farm management, should make application for instructions both to the Bureau of Plant Industry and to the Forest Service.

## FARMERS' BULLETINS.

The following is a list of the Farmers' Bulletins available for distribution, showing the number and title of each. Copies will be sent to any address on application to any Senator, Representative, or Delegate in Congress, or to the Secretary of Agriculture, Washington, D. C.

No. 22. The Feeding of Farm Animals. No. 24. Hog Cholera and Swine Plague. No. 25. Peanuts Culture and Uses. No. 27. Flax for Seed and Fiber. No. 28. Weeds: And How to Kill Them. No. 29 Souring and Other Changes in Milk. No. 30. Grape Diseases on the Pacific Coast. No. 31. Alfalfa or Lucerne. No. 32. Silos and Silage. No. 33. Peach Growing for Market. No. 34. Meats: Composition and Cooking. No. 35. Potato Culture. No. 36. Cotton Seed and Its Products. No. 37. Kafir Corn: Culture and Uses. No. 38. Spraying for Fruit Diseases. No. 39. Onion Culture. No. 41. Fowls: Care and Feeding. No. 42. Facts About Milk. No. 43. Sewage Disposal on the Farm. No. 44. Commercial Fertilizers. No. 45. Insects Injurious to Stored Grain. No. 46. Irrigation in Humid Climates. No. 47. Insects Affecting the Cotton Plant. No. 48. The Manuring of Cotton. No. 49. Sheep Feeding. No. 50. Sorghum as a Forage Crop. No. 51. Standard Varieties of Chickens. No. 52. The Sugar Beet. No. 54. Some Common Birds. No. 55. 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